

Easy Pathology

— Dr. Abdelrahman Khalifa —

Cardiovascular System

Part 2



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Atherosclerosis

Progressive disease, affecting small and large arteries, and characterized by lipid deposition in intima followed by thickening and calcification of vascular wall

Incidence: males > females. Age > 45 y.

Predisposing factors (risk factors):

- **Non modifiable**

- Age
- Sex: male > female. Incidence in female is increased *after menopause*
- Family history of atherosclerosis (e.g. **familial hypercholesterolemia**)



- **Modifiable factors**

- **Major (4 H)**

- **H**yperlipidemia (**LDL**) with low HDL: due to Obesity, high intake of animal fat, nephrotic syndrome, hypothyroidism
- **H**ypertension
- **H**yperglycemia (DM) : leads to hyperlipidemia
- **H**heavy smoking : *proved to induce endothelial damage*

- **Minor (4 S)**

- **S**ugar intake
- **S**teroid intake (*anabolic steroids*)
- **S**tress (*Type A personality*)
- **S**edentary life (*lack of exercise*)



Pathogenesis exact mechanism is unknown

- **Insudation theory (Response to endothelial injury)**

- Endothelial injury → deposition of **LDL** due to high blood pressure
- Attraction of macrophage → phagocytosis of Lipid (**Foam cells**) → lipid oxidation → more endothelial damage
- Platelets & macrophage secrete → cytokines & GF (**PDGF, FGF, TNf**)
- Proliferation of **smooth muscles & Matrix protein** in intima
- Excessive **vascularization** of the wall

- **Thrombogenic theory**

- Endothelial injury → Thrombosis
- Thrombus **organization** → **incorporation** (retraction) of thrombus into the wall
- Atheroma is the retracted thrombus. Lipid content is derived from cells forming thrombus, and not from LDL in blood.

Sites: Large & small arteries: **Aorta – coronaries – cerebral – carotid – mesenteric – Renal – Popliteal.**

More common in the **ostium** of artery (due to hemodynamic current → endothelial stress)

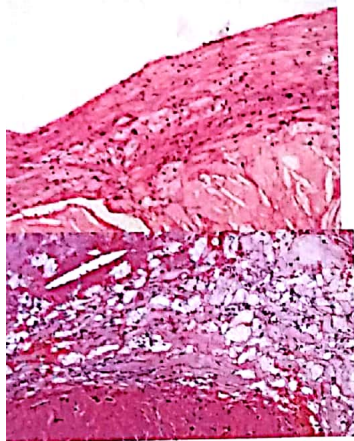
Morphology:

- **Fatty streaks** (progressive from young age up to 20 years age)
 - **Gross:** **yellow**, flat streaks (common in aortic orifice)
 - **Micro.:** Clear fat **clefts** – **Foam** cells (macrophage & smooth muscles containing fat)



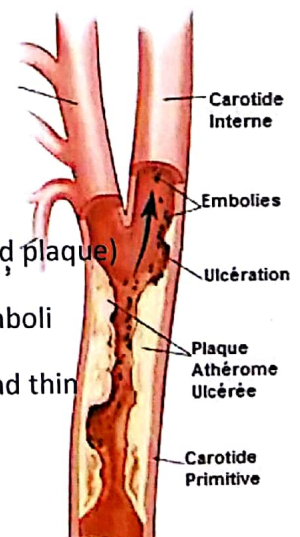
- **Atheroma plaque**

- **Gross:** White firm **cap** – yellow soft **core**
- **Micro.:**
 - **Fibrous cap:**
 - Macrophages
 - Proliferated **smooth muscle** & **Collagen** in intima
 - **Lipid core:**
 - **Foam** cells & needle shaped **cholesterol clefts**
 - **Dystrophic Calcification**
 - **Basal zone** : smooth muscle & connective tissue + **vascularization**
 - **Atrophy of the media**



- **Acute Complicated Atheroma**

- **Thrombosis** on top of atheroma (due to end injury & ruptured plaque)
- **Ulceration** & detachment (ruptured plaque) → cholesterol emboli
- **Hemorrhage** inside atheroma (due to weak vascularization and thin fibrous cap) → sudden occlusion or detachment



Complications:

- **Large Arteries (e.g. Aorta)** → **Aneurism** & mural thrombosis
- **Small & medium sized arteries (e.g. coronary)** → **ischemia** → infarction
- **Lower limb arteries** → ischemia → claudications → **dry gangrene** of the limb



Hypertension

(*Arterio-sclerosis*)

Progressive elevation of blood pressure >140 systolic, and >90 diastolic, with subsequent thickening of arterioles.



Types:

- According to Aetiology

- 1ry (idiopathic) 95%

- Sensitivity to Angiotensin → V.C. & vascular thickening
 - Salt intolerance (increased renal tubular Reabsorption)
 - Secretion of Aldosteron

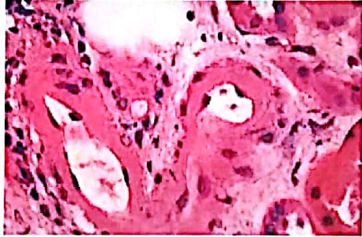
Predisposing factors: Stress, Salt intake & Smoking

- 2ry

- Neurogenic (increased intra cranial pressure)
 - Endocrinal (Cushing, Conn's, pheochromocytoma)
 - Renal (Nephritis, congenital dis, vascular dis. tumors)
 - Vascular & blood dis (Aortic coarctation , A-V shunt, polycythemia)
 - Eclampsia & pre-eclampsia (Renal Toxemia of pregnancy)

- According to course

- Benign (*hyaline arteriosclerosis*) : gradual onset, long duration
 - Malignant (*Hyperplastic arteriosclerosis*) : rapid onset, short duration

	Benign hypertension (hyaline)	Malignant hypertension (hyperplastic)
Age	> 50	<30
Onset	gradual	sudden
duration	long	Short (fatal)
BP	Less than 200/100	High 280/180
Morphology	<u>Arteries:</u> Atherosclerosis & its complications <u>Arterioles:</u> <u>Gross:</u> Arterioles have thick wall , narrow lumen <u>Microscopic:</u> -Elastosis -Hyalinosis 	<u>Arteries:</u> Atherosclerosis & its complications <u>Arterioles:</u> <u>Gross:</u> very thick wall , multiple layers (onion skin) <u>Microscopic:</u> -Hyperplasia of S.M. & basement membrane -Fibrinoid necrosis (permeation of fibrin in the wall) -Ruptured vessels 
Complications	<u>Benign nephrosclerosis</u> <u>Gross:</u> Contracted kidney <u>Micro:</u> Arterioles: (as described above) <u>Heart:</u> Left sided hypertrophy → congestive HF <u>Brain:</u> Cerebral hemorrhage (strokes)	<u>Malignant nephrosclerosis</u> <u>Gross:</u> Red spots (flea –bitten) <u>Micro:</u> Afferent Arterioles: (as described above) Glomeruli & tubules : hemorrhage <u>Left ventricular hypertrophy is minimal</u> <u>Cerebral hemorrhage (strokes)</u> <u>Retinal hemorrhage & papilloedema</u>
Causes of death	Congestive H.F. (45%) , IHD (45%), Cerebral hemorrhage (5%), Renal failure (5%)	Mainly by Renal failure 95 % IHD & H.F., cerebral hemorrhage

Aneurism

Focal abnormal dilatation of cardiac wall or arterial wall

True Aneurisms

Atherosclerotic aneurism	Syphilitic aneurism	Dissecting Aneurism	Mycotic aneurism	Congenital aneurism
<u>Sites</u> Aorta (abdominal)	<u>Sites</u> Aorta (ascending thoracic)	<u>Sites</u> Aorta (arch)	<u>Sites</u> coronary, cerebral, mesenteric	<u>Sites</u> Cerebral arteries Circle of Willis
<u>Causes</u> -Atherosclerosis Leads to weak media, and detached atheroma	<u>Causes</u> -Atherosclerosis -Syphilis	<u>Causes</u> -Media necrosis (occluded vasa vasorum due to hypertension) -congenital defect in the media (myxomatous change) → ruptured vasa vasorum	<u>Causes</u> Weak wall due to -SBE -TB	<u>Causes</u> Congenital
<u>Morphology</u> Fusiform	<u>Morphology</u> Saccular	<u>Morphology</u> Intramural blood between layers of the wall	<u>Morphology</u> saccular → Thrombosis - ruptured	<u>Morphology</u> Spherical (berry aneurism) → cerebral hemorrhage

Other types: Aneurism of PAN - Microaneurisms in hypertension

Complications of Aortic aneurisms:

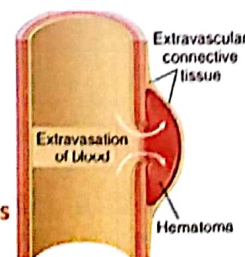
Compression atrophy , Ruptured aneurism (Hemothorax, hemopericardium, abdominal hemorrhage) , Thrombosis, coronary occlusion

False Aneurisms

Pulsating hematoma : Traumatic hematoma. The wall is formed by compressed tissue

A-V Fistula : Developmental – Traumatic – Inflammatory necrosis – Surgical in **hemodialysis**

Complication: Shunt of blood from arteries → veins → increased **venous return** → High output H.F.



Varicose veins

Congested, dilated, elongated, tortuous veins

Aetiology :

- Weak veins (*Age related*) *more in females*
- High pressure (*e.g. prolonged standing, portal hypertension*)

Sites :

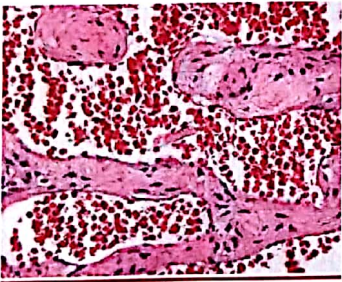
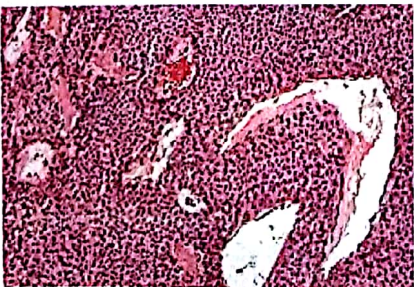
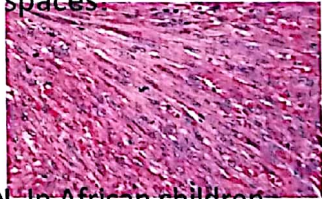
- Superficial veins of the **lower limb**
- **Porto-systemic** anastomosis

Complications

- Edema
- Ruptured venules → hemorrhage
- Thrombosis → embolism
- Trophic skin lesions → varicose ulcer → infection → thrombophlebitis



Vascular tumors

Benign	Malignant
<u>Hemangioma</u> (capillary & cavernous)  <u>Glomangioma</u> Occur under finger nails Vascular spaces + glomus cells Painful 	<u>Kaposi sarcoma</u> caused by <u>HHV-8</u> Gross: red or purple lesion Micro: <u>Slit-like</u> vascular spaces <u>Spindle</u> malignant cells extravasated RBCs  types: <u>AIDS-related:</u> viscera & LN. In African children <u>Classic European type:</u> Lower limb skin. In <u>Old</u> age <u>African endemic type:</u> LN. in <u>young</u> age <u>Post-transplantation type:</u> LN & viscera <u>Angiosarcoma</u> Skin, Liver, breast In Liver: caused by chemicals (e.g. <u>arsenic</u>) <u>Communicating vascular spaces, lined with malignant endothelium</u>

Vasculitis

Pathogenesis:

- Immunological
 - Immune complex type III hypersenset.(e.g. SLE, PAN, drug)
 - Anti-neutrophil cytoplasmic Ab ANCAs (e.g. Wegener)
 - Anti endothelial Ab (e.g. Kawasaki)
- Infections
 - Direct by organism
 - Indirect → immune mediated reaction
- Other causes (e.g. radiation, Trauma, Chemicals)

Complications: Ischemia – Thrombosis - Ruptured vessels → hemorrhage

Types:

Large to small vessel

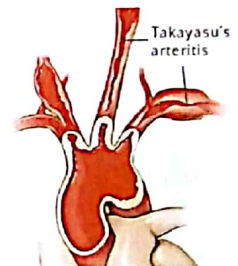
- **Giant cell (temporal) arteritis**

T-cell mediated - Temporal & ophthalmic – Old males – granuloma with giant cells



- **Takayaso**

Aorta and its branches – middle age - granuloma



Medium vessel

- **Poly Arteritis Nodosa PAN**

Multiple arteries mostly renal (not affecting pulmonary vessels)

Immune complex reaction , may be associated with **HBV** infection

gross: multiple nodules - multiple aneurisms

micro: **necrotizing inflammation** + excess **neutrophils** → chronic & fibrosis

- **Kwasaki**

Multiple vessels – Children - **necrotizing inflammation** with **mucocutaneous** & **LN** syndrome & strawberry tongue

Small vessel

- **Wegner granulomatosis**

respiratory tract & Kidney– **cANCA** - **granuloma** & necrotizing vasculitis

- **Churg-straus**

respiratory tract - Asthma – **pANCA** - **granuloma** & eosinophils

- **Microscopic polyangitis**

respiratory tract & Kidney – **ANCA** or no immune deposit - necrotizing

Burger's disease	Raynaud phenomena
Male smokers (genetic, immune, effect of <u>tobacco</u> on endothelium)	Females > males exposure to <u>cold</u> or <u>emotion</u>
Small & medium vessels of <u>Limbs</u>	Small arteries
Inflammation of <u>arteries</u> <u>veins</u> & <u>nerves</u> → thrombosis with microabscesses → fibrosis	1ry: exaggerated vasospasm 2ry: to arterial diseases (SLE, burger)
Cold sensitivity & pain Claudications Trophic ulcers Gangrene 	Cold sensitivity & pain Cyanosis of fingers, nose, ear 

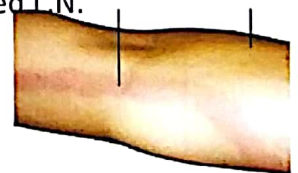
S.V.C. syndrome

Lung carcinoma → invade S.V.C. → Obstruction → Congestion & cyanosis of head and arms

**I.V.C. syndrome**

Cancer or thrombus → Obstruction → L.L. edem + renal congestion & proteinurea

Lymphangitis: Inflamed lymphatic vessels (red streaks) with painful enlarged L.N. (lymphadenitis)



Lymphedema: discussed in general pathology (circulatory)

Chylus effusion: Milky fluid (lymph) in serous sacs due to ruptured lymphatics

Congenital vascular diseases:

A-V fistula - Congenital berry aneurism – Fibromuscular dysplasia (Thick wall of large and medium sized arteries)

Monckeberg disease: Senile idiopathic dystrophic Calcification of Media in muscular arteries . **Without** narrowing of lumen. No symptoms.

Match

1. Benign Hypertension
 2. Aortic atherosclerosis
 3. Burger's disease
 4. Monckberg's disease
 5. Giant cell arteritis
 6. Wegner's vasculitis
 7. Renauld's disease
 8. Mycotic aneurism
 9. Malignant hypertension
 10. Glomangioma
 11. Kaposi sarcoma
 12. Kawasaki vasculitis
-

- A. Benign vascular tumor
- B. Vascular inflammation related to smoking
- C. Elastosis & hyalinosis
- D. Temporal arteritis
- E. Idiopathic calcification of media
- F. Glomerulonephritis, mucosal ulceration , ANCA
- G. Malignant spindle cells
- H. Strawberry tongue
- I. Foam cells
- J. Arteriolar vasospasm
- K. SBE
- L. Onion skin hyperplasia

Complete

- A. Foam cells are lipid-laden..... &
- B. Most common site of aortic atherosclerosis
- C. Hemorrhage of atheromatous plaque is caused by.....
- D. Atheromatous plaque with thin fibrous cap is liable to &
- E. The etiology of Monckberg disease is
- F. Mechanism of Kawasaki vasculitis is mediated by
- G. The commonest cause of death in benign hypertension is.....
- H. The commonest cause of death in malignant hypertension is.....
- I. Large artery vasculitis include..... &
- J. Excessive perivascular eosinophils is pathognomonic for.....vasculitis
- K. Dissecting hematoma is caused by Or
- L. Causes of A-V fistula include.....,, &
- M.is a malignant vascular tumor lined by malignant endothelium
- N. Pituitary causes of hypertension include..... &
- O. Renal causes of 2ry hypertension includes.....,,
- P. Blood pressure in essential hypertension is more than..... but less than

Cases

Patient with history of attacks of wheezy chest and dry cough, is complaining of ulcerative lesions in the nose and upper respiratory tract. Biopsy revealed vasculitis with striking perivascular eosinophils.

- 1- Most possible diagnosis**
- 2- Give reason: ulceration of respiratory tract**
- 3- Lab investigation to support diagnosis**

Male patient 55 years old is complaining of weak pulse in lower limb. Recent transient ischemic attacks are reported. History of smoking and high lipid LDL profile.

- 1- Possible diagnosis**
- 2- Microscopic findings of arteries**
- 3- Possible complications?**

Male patient 60 years old is complaining of progressive headache and visual disorders. Blood pressure is 160 / 100 . Abdominal ultrasound revealed contracted kidneys.

- 1- Possible diagnosis**
- 2- Microscopic findings of the kidney?**
- 3- Possible complications?**